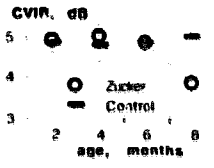
of age. Despite preserved systolic (FS, Vcf_c, peak + dP/dt/LVP p = NS for all; σ_{es} 60 ± 5 vs 103 ± 23, p < 0.01; control vs Zucker, respectively), and diastolic (mitral E/A, DT, pulmonary vein S/D, peak-dP/dt/LVP p = NS for all) function, Zucker rats showed a marked decrease in CVIB beginning at 8 months of age (see graph).



Conclusion: 1) Insulin resistant state is associated with abnormal ultrasonic scattering properties of the myocardium, 2) changes in the physical properties of the myocardium appear to be independent of systolic and diastolic LV function, or the development of LVH.

1205-141 Improved Correlation Between Myocardial Fibrosis and Integrated Backscatter With Extended Dynamic Range Radiofrequency Imaging

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Background: In vitro and animal studies have shown a correlation of myocardial (myo) integrated backscatter (IB) and collagen. If enddiastolic (ED) IB values in humans could be used for assessing fibrosis is unknown.

Methods: In 21 patients (Pts) with dilated cardiomyopathy waiting for heart transplantation (TX) ED unprocessed linear radiofrequency (RF) signals of ultrasonic parasternal LAX and SAX were digitized (20 MHz sampling rate 8 bit, 48 dB dyn.range). Amplification was first optimized for PW myocardium (a) and then (b) for pericardium (PE). IB was determined in defined ROIs in the proximal septum (VS), posterior wall (PW) and in both datasets in PE behind the PW. Absolute IB in PW and VS and values normalized for PE (a) and PE (b) were correlated with quantitative measurements of connective tissue content (CTC) determined in Masson s trichromic stained multiple sections of 1 x 1 cm myo cubes taken from precisely corresponding PW and VS regions at the time of TX. CT values from each 10 sections along (al) & perpendicular (pe) to main myo fibre direction were averaged.

Results: Table shows r-values of correlations. * = 0.05/0.01/0.005

	PW CTCpe		VS CTCpe		PW CTCal		VS CTCal	
	LAX	SAX	LAX	SAX	LAX	SAX	LAX	SAX
IBabs	0.41	0.38	0.25	0.39	0.34	0.36	0.33	0.52*
IB (a)	0.58*	0.49*	0.39	0.59**	0.43	0.49*	0.25	0.54**
IB (b)	0.64***	0.60***	0.39	0.53*	0.55**	0.65***	0.53*	0.64***

Conclusion: The study confirms in vivo a significant correlation between myo CTC and IB. In RF data optimized for PW myocardium PE is often oversaturated precluding true calibration of myo IB. Superior correlation is achieved, if the dynamic range of RF imaging is mathematically extended by use of a separate RF data set optimized for PE. Myo IB measurements normalized as described seem to facilitate estimation of collagen content.

1205-142 Effect of Atrial Contraction on Left Ventricular Integrated Backscatter: A New Insight Into the Mechanism of Cyclic Variation

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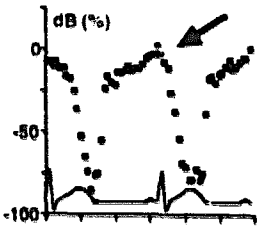
No data exists regarding the contribution of atrial contraction to the cyclic variation of integrated backscatter (CVIB) in the left ventricle (LV). We, therefore, examined 20 healthy volunteers and 12 lone atrial fibrillation patients using 2-D format IB analyzing system (SONOS 2500). IB data were obtained from the LV posterior wall (LVPW) and the septum (IVS) by the long-axis and the short-axis view. IB were measured at 30 msec intervals from the R wave on EKG and the 60 scatter plots were displayed.

Results: CVIB were observed in all subjects and the reproducibility was high in LVPW by the long-axis view. Although the peak value of IB were observed at the end-diastole in both groups, the pattern of CVIB was quiet different between two groups. IB showed two peaks in diastole only in the healthy subjects and the second peak occurred just after the atrial contraction (Fig). The 2nd peak showed 16 ± 3 % increase in dB as compared with the 1st peak. Although the magnitude between the first peak and the second peak was larger in LVPW than in the IVS (3.8 ± 1.1 vs. 2.5 ± 0.9 dB, p < 0.01), the timing was same in both regions.



Conclusions: IB in LV increased after atrial contraction probably due to "passive stretch" of the myocardium. These data indicate that the sarcomere length may be an important determinant of CVIB in normal myocardium.

1206 Noninvasive Imaging: Coronary Arteries, Ventricular Function, and Myocardial Infarction

Wednesday, April 1, 1998, Noon–2:00 p.m.
Georgia World Congress Center, West Exhibit Hall Level
Presentation Hour: Noon–1:00 p.m.

1206-143 Prognostic Value of a Normal Rest-Stress Myocardial Perfusion Positron Emission Tomography (PET): A Long Term Follow up Study

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Prognostic significance of a normal rest-stress myocardial perfusion PET study is not well known. Accordingly, 176 consecutive patients (Pts) with a normal PET study were followed for 1 to 6.6 years (yrs) (mean: 4.1 yrs) for development of hard (death or myocardial infarction) and soft (angina requiring revascularization) coronary events. 13-N ammonia was injected at rest and during pharmacologic stress and PET images were interpreted as normal by two blinded observers. There were 135 males and 38 females, age 52 ± 10 yrs. All Pts had either chest pain, multiple risk factors, or a positive treadmill electrocardiogram before the PET study. The pre-PET likelihood of coronary disease was intermediate to high (> 15%) in 46% of Pts. Of the 173 Pts (98%) who were successfully followed up, 2 had myocardial infarction (at 4.5 and 4.7 yrs) and 7 had coronary angioplasty (0.4 to 5.2 yrs) after their PET study. In conclusion, these data suggest that a normal rest-stress myocardial perfusion PET study is associated with a very low incidence of subsequent hard and soft coronary events.

1206-144 The Elusive Link Between Coronary Flow and Functional Reserve in Mild Dilated Cardiomyopathy: A Positron Emission Tomography and 2D-Echocardiography Study

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Background: Abnormal myocardial blood flow (MBF) and flow reserve can be detected in patients with mild dilated cardiomyopathy (DC) who also exhibit an heterogeneous response to low dose adrenergic stimulation.

Method: In order to explore the possible link between coronary flow and ventricular functional response during pharmacological stress, 15 patients with mild DC (12 men; age = 48 ± 7 yrs; NYHA class I–II; LV ejection fraction = 39 ± 7%) were studied. Regional MBF was measured by positron emission tomography and 13N-ammonia, at rest and following i.v. dipyridamole (0.56 mg/kg over 4'), and results compared with those obtained in 14 normal subjects. DC patients underwent low dose (up to 10 μg/kg/min) dobutamine (dob) echocardiography. Regional wall motion (RWMS) was evaluated in 5 LV segments per patient, scored from 1 = normal/hyperkinetic to 4 = dyskinetic, to be compared with regional MBF data.

Results: During stress, 3 patterns of echocardiographic response were identified for each segment: "normal" (RWMS: rest = 1, dob = 1), n = 19; "responders" (RWMS: rest >1, improvement ≥1 grade after dob), n = 31; "non-responders" (RWMS: rest >1, no change after dob), n = 25. In DC patients, regional coronary flow reserve was similar in normal (2.04 ± 0.61), responders (2.40 ± 1.12) and non-responders (2.17 ± 0.87) segments. In each of these subsets the flow reserve was significantly lower than in normal control subjects (3.71 ± 1.08, p < 0.01).

WEDNESDAY POSTER

Conclusion: patients with mild DC exhibit a diffusely blunted MBF reserve in comparison with normal controls; in DC segments the contractile response to low dose dobutamine is unrelated to regional coronary flow response to dipyridamole.

1206-145 Quantitation of Infarct Size in Rat Myocardium Using F-18 Deoxyglucose and a New High-Resolution microPET System

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Background: PET imaging of small animals may allow the study of transgenic disease models or facilitate the evaluation of new radiopharmaceuticals. Therefore, we explored the potential of a new high-resolution (~2 mm) microPET system for imaging the myocardium in 16 male rats weighing 344 ± 42 g.

Methods: The left coronary artery was ligated in 8 rats and 8 rats were sham operated. After 1.5 hrs, F-18 deoxyglucose (FDG; 1.5 mCi) was injected iv; 2.5 hrs later, 3-D data were acquired for 30 min. In each rat, 4 to 6 LV short-axis cuts were reconstructed with filtered backprojection. Relative threshold counts for the anterior and inferior LV circumference were derived from the control rats and applied to the infarct rats. The ratio of the total tracer uptake defect area to the LV cross-sectional area R_{PET} was determined in each infarct animal. The heart was removed, sliced into 4 to 6 sections and stained with TTC.

Results: The total infarct-to-LV ratio R_{TTC} on digital planimetry varied from 2 to 54%. R_{PET} correlated linearly with R_{TTC} ($r = 0.95$, < 0.001) but tended to underestimate infarct size. The two smallest infarcts (2% and 6%) were seen only on the TTC sections but not on PET.

Conclusion: High-resolution microPET affords the noninvasive visualization of regional myocardial tracer uptake and uptake defects in only 11 mm large hearts with a 2 mm thick LV wall. Thus, microPET allows use of small laboratory animals for studying for example transgenic rat models or new radiopharmaceuticals at a low cost.

1206-146 Clinical Significance of Increased Fluorine-18 Deoxyglucose (FDG) Uptake in Normoperfused Myocardium Without Ischemic Insult Under Fasting Condition

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Purpose and Methods: Increased uptake of FDG in hypoperfused area is considered to indicate ischemic but viable myocardium. However, increased FDG uptakes are also observed in normoperfused myocardium without ischemic injury (normal myocardium) under fasting condition. To evaluate the clinical significance of increased FDG uptakes in normal myocardium under fasting condition, we performed nitrogen-13 ammonia (NH_3) and FDG positron emission tomography (PET) in 66 consecutive patients with ischemic heart disease [42 were myocardial infarction (MI), 19 were variant angina (VA) and 5 were effort angina (EA).; 51 men]. Patients with overt diabetes were excluded. When PET images were analyzed excluding the infarct-related area, the tertory of coronary arteries having significant stenosis and showing vasospasm, 16 (group A) showed increased FDG uptakes in the area of normal NH3 uptakes and 50 (group B) did not. The upper limit of normal FDG uptake was defined as the mean + 2SD of normal data in our institution.

Results: The serum glucose levels (98 ± 10 mg/dl vs 98 ± 12 mg/dl) and insulin levels (7.6 ± 5.5 IU/l vs 8.1 ± 3.9 IU/l) were not defferent between two groups. The serum free fatty acid levels were lower in group A than in group B (0.47 ± 0.16 mEq/l vs 0.62 ± 0.28 mEq/l, $p < 0.05$), but the values were within normal range (0.50 ± 0.35 mEq/l). The distribution of clinical diagnosis were not different between 2 groups (MI; 9, VA; 6, EA; 1 vs MI; 33, VA; 13, EA; 4). When patients were re-classified into "Active-group" (within 2 weeks after onset of MI and the phase of unstable angina) and "Inactive-group", 10 of 16 group A patients (63%) were included in Active-group, but only 5 of 50 group B patients (10%, $p < 0.01$).

Conclusions: Our data indicate that an increase in FDG uptake in normal myocardium are closely related to contiguous phase of critical myocardial ischemic events, suggesting that myocardial ischemic events may produce acceleration of glucose utilization even in remote normal myocardium.

1206-147 Impairment of Myocardial Blood Flow Reserve, in Patients With Coronary Artery Disease and Heart Failure, Depents on Severity of Left Ventricular Dysfunction and Not Severity of Coronary Stenosis

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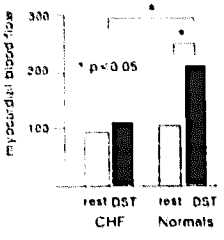
Background: Myocardial blood flow reserve (MFR) is impaired in patients with coronary artery disease (CAD), not only in arteries with significant (>70%), but also non-significant lesions. We examined whether this MFR-impairment would be related to the degree of LV dysfunction.

Methods: We studied 12 pts with CAD and congestive heart failure (CHF) (LVEF 0.34 ± 0.02, age 63 ± 3) and compared them with 12 age and sex-matched controls with similar CAD (LVEF 0.56 ± 0.03, age 64 ± 4). Medication was withheld pre-study, depending on the plasma half time. MFR was assessed with positron emission tomography and N-13 ammonia at rest and after infusion of dipyridamole, in the non-infarcted related artery (non-IRA).

Results: In stenotic non-IRA coronary arteries MFR was impaired in both groups (p = NS).



In contrast, in the non-stenotic (< 70% stenosis) non-IRA coronary arteries, MFR was impaired during dipyridamole stress test (DST) in CHF (fig). Further, in CHF, patients MFR showed a relation ($r = 0.6$, $p < 0.05$) with LVEF, but not with the severity of CAD.

Conclusion: In patients with CHF with underlying CAD and non-stenotic coronary arteries, myocardial blood flow at rest was similar, but MFR was impaired, which correlated with LVEF. The impairment of flow reserve may play an important role in the pathogenesis of ischemic heart failure.

1206-148 Prospective Assessment of Left Ventricular Adaptation With Electron Beam Computed Tomography (EBT) in High vs. Low Exercise Rehabilitation After First Anterior Myocardial Infarction

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High level (Phase II) exercise in patients (pts.) with large myocardial infarctions (MI) has been controversial. This prospective trial was designed to quantitatively assess cardiac size, function and infarct size in 30 pts. (5 women) randomized to regular (Phase I & II, "high") or "low" exercise (no increase in VO2 uptake) after first Q-wave MI. All pts. underwent supervised training sessions for six months without knowledge of their group assignment and received β-blockers and ACE-inhibitors. The infarct-related vessels were patent. EBT and sestamibi scans were performed at discharge (5–10 days after MI, "base"), and 6 months to determine LV and RV enddiastolic (EDV), endsystolic (ESV), and stroke volumes (SV), as well as LVEF, LV muscle mass (MM), and infarct size. The two groups did not differ in age (56 ± 12 vs 56 ± 12 yrs), infarct size (34 ± 25 vs 29 ± 22% of LV) or number of significant stenoses. Results are shown below:

	High 6 months	Δ from base	Low 6 months	Δ from base
LVEDV [ml]	215 ± 57	14 ± 42	190 ± 46	2 ± 27
LVESV [ml]	119 ± 48	9 ± 35	102 ± 43	0 ± 28
LVSV [ml]	96 ± 23	5 ± 17	87 ± 13	2 ± 22
LVEF [%]	46 ± 9	0 ± 7	48 ± 10	0 ± 11
RVEDV [ml]	193 ± 43	14 ± 34	180 ± 31	7 ± 23
RVESV [ml]	106 ± 31	11 ± 29	90 ± 25	5 ± 17
MM [g]	179 ± 40	-3 ± 39	156 ± 30	-17 ± 26

Conclusion: 1) In patients with moderately large anterior MIs, treated with ACE inhibition, there is no significant change in cardiac function, volume, and muscle mass from baseline to six months. 2) There appears to be no detrimental effect of high level rehabilitation exercise on cardiac size and function parameters.